PATENT SPECIFICATION (11) 1 239 579

DRAWINGS ATTACHED

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(54) REINFORCEMENT OF THERMOPLASTIC SHEET

(71) I, RICHARD JAMES COX, of British nationality of 56, Langley Park Road, Iver, in the county of Buckinghamshire, England, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of reinforcing synthetic thermoplastic polymeric sheet and associated structures resulting therefrom.

According to the method, single reinforcing wires are heated by passing through each wire an electrical current of magnitude to heat a plastic coating adhering to each reinforcing wire. Whilst the plastic coated wires are in a heated condition the thermoplastic sheet and the plastic coated wires are pressed together and then cooled.

In the method heat from the plastic coating on the wire is transfered to the thermoplastic sheet creating a local molten or fusible surface on the sheet resulting in a permanent fused band when the two are pressed together.

In the method the reinforcing wire may be placed under tension in order to prevent distortion of the wire due to thermal expansion. The reinforcing wire may be so constrained in a straight condition.

The principle advantage of the method is that the reinforcing wire is attached to the thermoplastic sheet by a continuous fused permanent bond along the entire length of wire which is in contact with the thremoplastic sheet.

Bv way of example a particular embodiment of the method for flexible thermoplastic sheet will now be described with reference to fig. 1 of the accompanying drawing in which the surface of the platen 1 which applies pressure on the side of the thermoplastic sheet 3 may contain a groove into which the reinforcing wire 4 having a plastic coating 5 is located when the sheet and the wire are pressed between the platens 1 and 2. The groove may have a plurality of cross sectional shapes and may be dimensioned to ensure that the flexible thermoplastic sheet is wrapped over the surface of the wire when the sheet and the wire are pressed together. In this particular example of the method the wire and the locating groove have a circular cross sectional shape.

Conveniently the platen surfaces of the press which apply pressure to the reinforcing wire and the thermoplastic sheet may be arranged on the periphery of a cylindrical structure allowing for the continuous feed of the thermoplastic sheet and the bonding of single reinforcing wires, one following the other, for example in a calendar process. Each wire may be tensioned and heated according to the method by a feed mechanism ensuring the desired positioning of the wire. Reinforcing wires in this embodiment may be bonded in a calender process immediately following the extrusion of the thermoplastic sheet.

The term "wire" in this specification is intended to include metal rod, tube, or wire which may have a plurality of cross sectional shapes and be brought to the necessary temperature by passage of an electrical current. The wire may have an anti-corrosion coating under the plastic coating and in an example of the method, it may be galvanized iron wire. The term "wire" is also intended to include a composite wire built up of strands of wire twisted together.

The heating current which is passed through the reinforcing wire may conveniently be reduced or switched off at any time during the method and in particular for a metal wire of one cross sectional shape and dimensions it may be determined by trial without departing from the scope of the method.

The plastic coating on the reinforcing wire

and the thermoplastic sheet may be the same thermoplastic polymeric material and may, by way of example, be polyethlyene or polyproplyene, or the coating on the wire may be any plastic material providing it is compatible with the thermoplastic sheet and the two will satisfactorily bond together. The bonding may be improved, in a particular embodiment of the method, by addition to the plastic coating on the wire, materials which assist in the bonding or impart additional strength to the bond.

The thickness of the thermoplastic sheet will depend upon the end use for which the reinforced sheet is destined and may range from a film thickness of 0.005 millimetre up to thicknesses of the order of 5.0 millimetres.

Pre-coating of the reinforcing wire with plastic material may be by any of the normal methods used in the plastic coating of wire and may be coated by heating the wire until the wire reaches a temperature that will melt a thermoplastic material at which temperature the wire is submerged in a fine powder form of the thermoplastic material and then cooled. A further method of precoating the wire is by heating the wire to the melting temperature of a thermoplastic material at which temperature the wire is passed through a compartment containing the thermoplastic material in fine powder form suspended in a turbulent gas and then cooled. The reinforcing wire may be suitably pre-coated without heating the wire by sliding over the wire a tubular form of the plastic material

The invention also includes structures made by the methods described. The structures may be built by bonding each reinforcing wire across the breadth of the thermoplastic sheet one wire parallel to the next as indicated in fig. 2 in the accompanying drawing. This distance between each wire will depend upon the particular end use for which the structure is to be used. The reinforcing wires may be greater in length than the distance across the breadth of the thermoplastic sheet such that the wires extend beyond the edges of the sheet on one or either side.

For the flexible thermoplastic sheet, bonding each wire parallel to the next in one direction only, across the breadth of the sheet, renders the flexible sheet extensible in a general direction along the length of the sheet. Extensile reinforced flexible thermoplastic sheet may also be achieved by a further embodiment of the invention where each reinforcing wire is bonded diagonally across the breadth of the sheet in a zig-zag configuration as indicated in fig. 3 of the accompanying drawing permitting the wire ends, which may extend beyond the edges of the sheet, to be linked together.

Sheet structures according to the invention which are wire reinforced by the methods described and are extensible in a direction along the length of the sheet generally at right angles to the reinforcing wire permit a plurality of constructional and protective end uses.

A further embodiment of the invention is a structure in which two or more sheets of flexible thermoplastic material may be bonded to single reinforcing wires by the methods described and then heat sealed along the edges between the reinforcing wires. The sheets are separated over the area between the wires by an air or other gas filling. Such structures may be used for constructional and protective purposes in which increased thermal insulation is a required feature.

WHAT WE CLAIM IS:—

1. A method of reinforcing synthetic thermoplastic polymeric sheet with single plastic coated wires which are individually heated by passing through each wire an electric current, the heat so generated in the wire raising the plastic coating on the wire to a temperature sufficient to form a local molten surface on the thermoplastic sheet when the wire and the thermoplastic sheet are pressed together, the system being allowed to cool after pressing together the heated wires and thermoplastic sheet.

2. The method as claimed in claim 1 in which the reinforcing wire is tensioned whilst it is being heated and cooled.

3. The method as claimed in claims 1 and 2 in which the reinforcing wire is located in a groove in a platen when the wire and the thermoplastic sheet are pressed together.

4. The method as claimed in any of the preceding claims 1 to 3, in which the operations are performed in a calender process.

5. The methods of reinforcing synthetic thermoplastic polymeric sheet substantially as hereinbefore described with reference to figure 1, of the accompanying drawing.

6. A structure comprising a synthetic thermoplastic polymeric sheet and reinforcing wires bonded across the breadth of the thermoplastic sheet one wire parallel to the next when prepared by the method claimed in any of the claims 1 to 5.

7. A structure according to claim 6 in which the reinforcing wires are greater in length than the breadth of the thermoplastic sheet and extend beyond the edges of the sheet on one or either side.

8. A structure comprising a synthetic thermoplastic polymeric sheet and reinforcing wires bonded across the breadth of the sheet in a zig-zag configuration when prepared by the method claimed in claims 1 to 5.

9. A structure according to claim 8 in which the reinforcing wires extend beyond

the edge of the thermoplastic sheet and are linked together.

10. A structure as claimed in claims 6, 7, 8 and 9 in which two or more sheets of thermoplastic material are bonded to single reinforcing wires and heat sealed together along the edges between the wires and separated over the area between the wires by an air or other gas filling.

11. A structure comprising reinforced synthetic thermoplastic polymeric sheet substantially as hereinbefore described.

12. A structure substantially as hereinbefore described with reference to figures 2 and 3 of the accompanying drawings.

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1,239,579 COMPLETE SPECIFICATION
1 SHEET

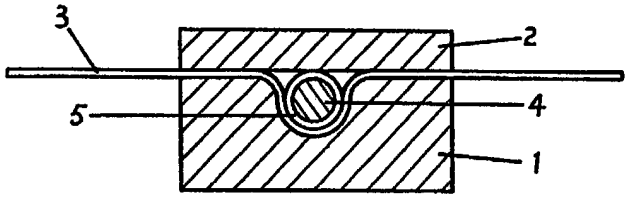

fig. 1.

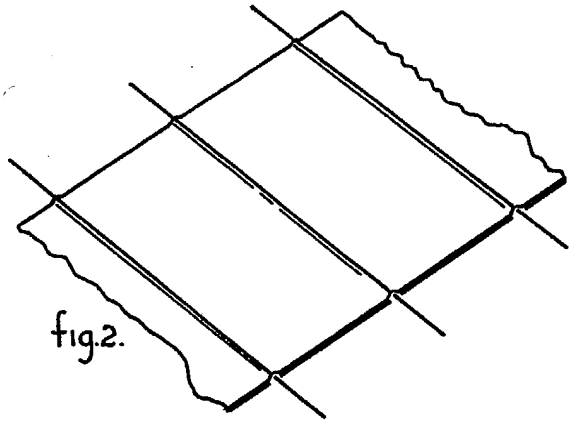

fig.2.

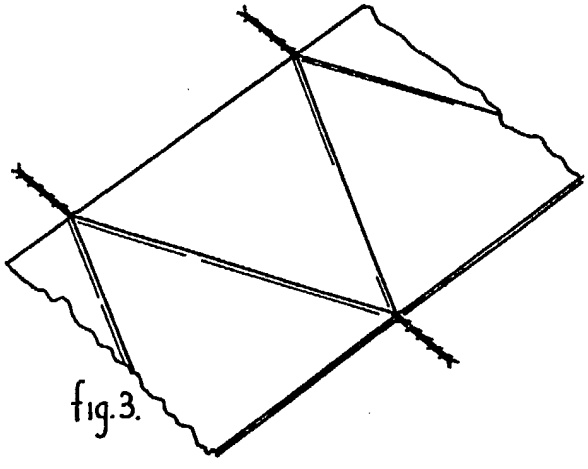

fig.3.